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11 August 1998

AGREEMENT

CONCERNING THE ADOPTION OF UNIFORM TECHNICAL PRESCRIPTIONS FOR WHEELED VEHICLES, EQUIPMENT AND PARTS WHICH CAN BE FITTED AND/OR BE USED ON WHEELED VEHICLES AND THE CONDITIONS FOR RECIPROCAL RECOGNITION OF APPROVALS GRANTED ON THE BASIS OF THESE PRESCRIPTIONS */

(Revision 2, including the amendments entered into force on 16 October 1995)

Addendum 82: Regulation No. 83

Revision 1 - Amendment 3

Supplement 1 to the 03 series of amendments - Date of entry into force: 14 May 1998

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF VEHICLES WITH REGARD TO THE EMISSION OF POLLUTANTS ACCORDING TO ENGINE FUEL REQUIREMENTS

UNITED NATIONS

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*/ Former title of the Agreement:

Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958.

GE.98- 22803

Paragraph 1.1., amend to read:

"1.1. This Regulation applies:

1.1.1. to exhaust emissions and crankcase gaseous emissions of all vehicles of categories M1 */ and N1 */, equipped with positive-ignition engines fuelled with leaded petrol.

1.1.2. to exhaust emissions, crankcase emissions, evaporative emissions and durability of pollution-control devices of all vehicles of categories M1 */ and N1 */ equipped with positive-ignition engines fuelled with unleaded petrol, or LPG only, or NG only, or which can be fuelled with either unleaded petrol or LPG, or NG, and

1.1.3. to exhaust emissions and durability of pollution control devices of all vehicles of categories M1 */ and N1 */ equipped with compression-ignition engines, and having at least four wheels.

1.1.4. Vehicles with a maximum laden mass of more than 3500 kg are not subject to the requirements of this Regulation, provided that they are equipped with engines that satisfy the requirements of Regulation No. 49 as amended by the latest series of amendments."

Paragraph 2.1., amend to read:

"2.1. "Approval of a vehicle" means the approval of a vehicle type with regard to the limitation of the following conditions:

2.1.1. Limitation of emissions of gaseous pollutants by the engine and crankcase emissions of vehicles fuelled with leaded petrol (Approval A).

2.1.2. Limitation of emissions of gaseous pollutants by the engine, evaporative emissions, crankcase emissions and durability of pollution control devices of vehicles fuelled with unleaded petrol, or which can be fuelled with either unleaded petrol and LPG or NG (Approval B).

2.1.3. Limitation of emissions of gaseous and particulate pollutants, crankcase emissions and durability of pollution control devices of vehicles fuelled with diesel fuel (Approval C).

2.1.4. Limitation of emissions of gaseous pollutants by the engine, crankcase emissions and durability of pollution control devices of vehicles fuelled with LPG or NG (Approval D)."

Paragraph 2.2., amend to read:

"2.2. "Fuel requirement by the engine", the type of fuel normally used by the engine:

leaded petrol
unleaded petrol
LPG (liquified petroleum gas)
NG (natural gas)
both unleaded petrol and LPG (liquified petroleum gas)
both unleaded petrol and NG (natural gas)
diesel fuel."

Paragraph 2.6., amend to read:

"2.6. "Gaseous pollutants" means

carbon monoxide

hydrocarbons assuming a ratio of $CH_{1.85}$ for petrol,
assuming a ratio of $CH_{1.86}$ for diesel fuel,
assuming a ratio of $CH_{2.525}$ for LPG,
assuming a ratio of CH_4 for NG, and

oxides of nitrogen, the latter being expressed in nitrogen dioxide (NO_2) equivalent."

Paragraph 4.4.1., footnote 1/, amend to read:

"1/ ..... 30 (vacant), 31 for Bosnia and Herzegovina, 32-36 (vacant), 37 for Turkey, 38-39 (vacant) and 40 for The former Yugoslav Republic of Macedonia. Subsequent numbers ..... to the Agreement Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions, ..."

Paragraph 4.4.3., amend to read:

"4.4.3. The following additional symbols corresponding to emission level normally required according to fuel requirements shall be affixed near the approval mark:

A - if corresponding to the level of emission of gaseous pollutants normally required for an engine fuelled with leaded petrol;

B - if corresponding to the level of emissions of gaseous pollutants, crankcase emissions, evaporative emissions and durability of pollution control devices normally required for

an engine fuelled with unleaded petrol, or which can be fuelled with either unleaded petrol or LPG or NG;

C - if corresponding to the level of gaseous and particulate emissions, and durability of pollution control devices normally required for an engine fuelled with diesel fuel;

D - if corresponding to the level of emissions of gaseous pollutants, crankcase emissions and durability of pollution control devices normally required for an engine fuelled with LPG or NG."

Paragraph 5.1.2., amend to read:

"5.1.2. A vehicle equipped with a positive-ignition engine and fuelled with unleaded petrol, or which can be fuelled with either unleaded petrol or LPG, or NG, shall satisfy paragraphs 5.1.2.1. or 5.1.2.2. below."

Paragraphs 5.1.2.1. and 5.1.2.2.2., amend the words "fuel tank" to read "petrol tank" (twice).

Paragraph 5.2.1., amend to read:

"5.2.1. Positive-ignition engine powered vehicles fuelled with petrol or LPG must be subject to the following tests, as shown in Table 1:

Type I: (Simulating the average tailpipe emissions after a cold start)
Type II: (Carbon monoxide emission at idling speed)
Type III: (Emission of crankcase gases)
Type IV: (Evaporative emissions)
Type V: (Durability of pollution-control devices)

Type IV test (evaporative emissions) is not required for vehicles fuelled with LPG or NG only (Approval D)."

Table 1: Approval system, replace by the following table (including also new footnotes 5/, 6/ and 7/):

"Table 1: Approval system

Type Approval Test	Vehicles fuelled with leaded petrol Approval A	Vehicles fuelled with unleaded petrol or with either unleaded petrol and LPG or NG 6/ Approval B	Vehicles fuelled with diesel fuel Approval C	Vehicles fuelled with LPG or NG 6/ Approval D
	(identical to Regulation No. 15.04) M1, N1	M1 vehicles 3/ N1 vehicles 4/	M1 vehicles N1 vehicles	M1 vehicles N1 vehicles
Type I	YES (mass ≤ 3.5 tonnes) Part 1	YES (mass ≤ 3.5 tonnes) Part 1 and Part 2 5/	YES (mass ≤ 3.5 tonnes) Part 1 and Part 2	YES (mass ≤ 3.5 tonnes) Part 1 and Part 2
Type II	YES	YES (mass > 3.5 tonnes) 5/	...	YES (mass > 3.5 tonnes)
Type III	YES	YES 7/	...	YES
Type IV	...	YES 7/ (mass ≤ 3.5 tonnes)	...	...
Type V	...	YES (mass ≤ 3.5 tonnes) 7/	YES (mass ≤ 3.5 tonnes)	YES (mass ≤ 3.5 tonnes)
Extension	paragraph 7	paragraph 7	paragraph 7; M2 and N2 vehicles with reference mass not more than 2840 kg	paragraph 7

3/, 4/ In application of paragraphs 5.1.2.1. (restricted filler orifice) and 5.1.2.2. (marking).

5/ Vehicles which can be fuelled with either unleaded petrol or LPG or NG shall be tested on both fuels.

6/ Vehicles fuelled with LPG or NG shall be tested according to the requirements of annex 12.

7/ Vehicles which can be fuelled with either unleaded petrol or LPG or NG should be tested on unleaded petrol only.

Insert new paragraphs 5.3.1.1.1. and 5.3.1.1.2., to read:

"5.3.1.1.1. Vehicles that are fuelled with LPG or NG (approval D) shall be tested in the test type I for variations in the composition of LPG or NG, as set out in annex 12.

Vehicles that can be fuelled either with petrol or with LPG or NG (approval B) shall be tested in the test type I on both fuels, of which the fuelling on LPG or NG has to be performed for variation in the composition of LPG or NG, as set out in annex 12.

5.3.1.1.2. Notwithstanding the requirement of paragraph 5.3.1.1.1. above, vehicles that can be fuelled with both petrol and a gaseous fuel, but where the petrol system is fitted for emergency purposes or starting only and of which the petrol tank cannot contain more than 15 litres of petrol will be regarded for the test type I as vehicles that can only run on a gaseous fuel."

Paragraph 5.3.1.4.2., amend to read:

"5.3.1.4.2. Emission levels of gaseous pollutants normally required for vehicles fuelled with unleaded petrol, or LPG or NG or which can be fuelled with either unleaded petrol or LPG or NG (Approval B or D)."

Paragraph 5.3.1.4.2.1., amend to read:

"5.3.1.4.2.1. For all M_1 vehicles equipped with a positive-ignition engine fuelled with unleaded petrol, or LPG, or NG, or which can be fuelled with either unleaded petrol or LPG or NG, the limits shall be:

....."

Paragraph 5.3.2.1., amend to read:

"... exceeding 3.5 tonnes (Approvals B and D)."

Insert new paragraphs 5.3.2.1.1. and 5.3.2.1.2., to read:

5.3.2.1.1. Vehicles that can be fuelled either with unleaded petrol or with LPG or NG (approval B) shall be tested in the test type II on both fuels.

5.3.2.1.2. Notwithstanding the requirement of paragraph 5.3.2.1.1. above, vehicles that can be fuelled with both petrol and a gaseous fuel, but where the petrol system is fitted for emergency purposes or starting only and of which the petrol tank cannot contain more than 15 litres of petrol will be regarded for the test type II as vehicles that can only run on a gaseous fuel."

Insert new paragraphs 5.3.3.1.1. and 5.3.3.1.2., to read:

"5.3.3.1.1. Vehicles that can be fuelled either with unleaded petrol or with LPG or NG (approval B) shall be tested in the test type III on unleaded petrol only.

5.3.3.1.2. Notwithstanding the requirement of paragraph 5.3.3.1.1. above, vehicles that can be fuelled with both petrol and a gaseous fuel, but where the petrol system is fitted for emergency purposes or starting only and of which the petrol tank cannot contain more than 15 litres of petrol will be regarded for the test type III as vehicles that can only run on a gaseous fuel."

Paragraph 5.3.4.1., amend to read:

"... exceeding 3.5 tonnes, and the vehicles fuelled with LPG or NG (Approval D)."

Insert a new paragraph 5.3.5.1.1., to read:

"5.3.5.1.1. Vehicles that can be fuelled either with unleaded petrol or with LPG or NG (approval B) shall be tested in the test type V on unleaded petrol only."

Paragraph 7.4., amend to read:

"7.4. Vehicle types equipped with a positive-ignition engine which presents only differences about fuel requirements

A vehicle type equipped with a positive-ignition engine adjusted according to the manufacturer's specifications to run on unleaded petrol, or equipped to run on LPG or NG or equipped so that it can run either on unleaded petrol or on LPG or NG, but for which the emission requirements correspond to the limits specified in paragraph 5.3.1.4.1.1. can be granted an "A" approval as provided in paragraph 4.4.3.

In this case, approval shall be extended for the leaded petrol functioning adjustments."

Paragraph 8.2.2., amend to read:

"8.2.2. Vehicles fuelled with unleaded petrol, or LPG, or NG or which can be fuelled with either unleaded petrol or LPG, or NG (Approval B or D)" and vehicles fuelled with diesel fuel (Approval C)".

Annex 1, Item 1.2.2., amend to read:

"1.2.2. Fuel: leaded petrol/unleaded petrol/diesel oil/LPG/NG 1/"

Insert new items 1.2.4.5. to 1.2.4.6.3.3., to read:

"1.2.4.5. By LPG fuelling system : yes/no 1/
1.2.4.5.1. Approval number according to Regulation No. 67 and documentation: . . . . . .
1.2.4.5.2. Electronic Engine Management Control Unit for LPG-fuelling:
1.2.4.5.2.1. Make(s): . . . . . .

1.2.4.5.2.2. Type: . . . . . .
1.2.4.5.2.3. Emission related adjustment possibilities: . . . . . .
1.2.4.5.3. Further documentation:
1.2.4.5.3.1. Description of the safeguarding of the catalyst at switch-over from petrol to LPG or back: . . . . . .
1.2.4.5.3.2. System lay-out (electrical connections, vacuum connections compensation hoses, etc): . . . . . .
1.2.4.5.3.3. Drawing of the symbol: . . . . . .

1.2.4.6. By NG fuelling system: yes/no 1/
1.2.4.6.1. Approval number according to Regulation No. 67: . . . . . .
1.2.4.6.2. Electronic Engine Management Control Unit for NG-fuelling:
1.2.4.6.2.1. Make(s): . . . . . .
1.2.4.6.2.2. Type: . . . . . .
1.2.4.6.2.3. Emission related adjustment possibilities: . . . . . .
1.2.4.6.3. Further documentation:
1.2.4.6.3.1. Description of the safeguarding of the catalyst at switch-over from petrol to NG or back: . . . . . .
1.2.4.6.3.2. System lay-out (electrical connections, vacuum connections compensation hoses, etc.): . . . . . .
1.2.4.6.3.3. Drawing of the symbol: . . . . . "

Annex 2,

Item 2, amend to read:

"2. Engine fuel requirements: leaded petrol / unleaded petrol / diesel fuel / NG / LPG: 2/ . . . . . "

Item 16.1., amend to read (including also a reference to a new footnote 4/ and a new footnote 4/):

"16.1. Results of approval tests: Carried out according to annex 4: 2/ 4/

CO: . . . . . g/test or g/km 2/
(HC + NO_X): . . . . . g/test or g/km 2/
Particulates: . . . . . g/test or g/km 2/

Ratio of emission results for the family in the case of gaseous fuel:
r_{CO} : ..... Ref. fuel ..... relative to Ref. fuel.....
r_{NOx} : ..... Ref. fuel ..... relative to Ref. fuel.....
r_{HC+NOx} : .... Ref. fuel ..... relative to Ref. fuel.....

4/ In the case of vehicles fuelled with LPG or NG: repeat for all reference gases of LPG or NG. In the case of vehicles designed to run either on petrol or on LPG or NG: repeat for petrol and all reference gases of LPG or NG."

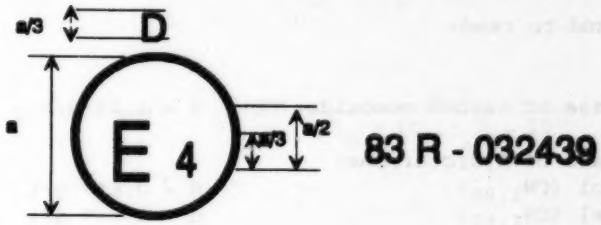
Annex 3,

Title concerning the approval B mark, amend to read:

"Vehicles approved to the emission levels of gaseous pollutants required for feeding the engine with unleaded petrol or with either unleaded petrol or LPG or NG - approval B."

Insert at the end the following new example:

Vehicles approved to the emission levels of gaseous pollutants required for feeding the engine with LPG or NG - approval D.



a = 8 mm min

The above approval mark affixed to a vehicle in conformity with paragraph 5.3.1.4.2. shows that the vehicle type concerned has been approved in the Netherlands (E4), pursuant to Regulation No. 83 level D under approval No. 032439. The first two digits of the approval number indicate that Regulation No. 83 already included the 03 series of amendments when the approval was granted."

Annex 4,

Paragraph 3.2., amend to read:

"3.2. Fuel

The appropriate reference fuel as defined in Annex 9 to this Regulation shall be used for testing. In the case of LPG or NG the provisions of Annex 12 shall apply."

Paragraph 5.3.1., add the following text at the end:

"....."
For positive-ignition engined vehicles fuelled with LPG or NG or so equipped that they can be fuelled with either petrol or LPG or NG, between the tests on the first gaseous reference fuel and the second gaseous reference fuel, the vehicle shall be preconditioned before the test on the second reference fuel. This preconditioning is done

on the second reference fuel by driving a preconditioning cycle consisting of one part one (urban part) and two times part two (extra-urban part) of the test cycle described in appendix 1 to this annex. On the manufacturer's request and with the agreement of the technical service this preconditioning cycle may be extended. The dynamometer setting shall be the one indicated in paragraphs 5.1. and 5.2. of this annex."

Insert a new paragraph 6.2.3., to read:

"6.2.3. In the case of the use of LPG as a fuel it is permissible that the engine is started on petrol and switched to LPG after a predetermined period of time which cannot be changed by the driver."

Paragraph 8.2., amend to read:

".....
In the case of carbon monoxide (CO): d = 1.25 g/l

In the case of hydrocarbons:
for petrol ($CH_{1.85}$) d = 0.619 g/l
for diesel ($CH_{1.86}$) d = 0.619 g/l
for LPG ($CH_{2.525}$) d = 0.649 g/l
for NG (CH_4) d = 0.714 g/l

In the case of nitrogen oxides (NO_2): d = 2.05 g/l
...."

Annex 4 - Appendix 5,

Paragraph 3.1.3.5.2., amend to read:

"..... less than 3 % by volume for petrol and diesel, less than 2.2 % by volume for LPG and less than 1.5 % by volume for NG."

Annex 4 - Appendix 6,

Paragraph 2.3., amend to read:

"..... Methane and purified air $1.00 \leq Rf \leq 1.15$
or $1.00 \leq Rf \leq 1.05$ for NG fuelled vehicles"

Annex 4 - Appendix 8,

Paragraph 1.3., amend to read:

"..... The dilution factor is calculated as follows:

For petrol and diesel:

$$DF = \frac{13.4}{C_{CO_2} + (C_{HC} + C_{CO})\ 10^{-4}} \qquad (5a)$$

For LPG:

$$DF = \frac{11.9}{C_{CO_2} + (C_{HC} + C_{CO})\ 10^{-4}} \qquad (5b)$$

For natural gas:

$$DF = \frac{9.5}{C_{CO_2} + (C_{HC} + C_{CO})\ 10^{-4}} \qquad (5c)$$

In these equations:
....."

Paragraph 1.5.2.3., the value of Q_{HC}, amend to read:

".....
Q_{HC} = 0.619 in the case of petrol or diesel
Q_{HC} = 0.649 in the case of LPG
Q_{HC} = 0.714 in the case of NG
....."

Annex 9, insert the following LPG and NG test fuels

*4. TECHNICAL DATA OF THE LPG REFERENCE FUELS

		Fuel A	Fuel B	Test method
Composition:				ISO 7941
C3	% vol.	30 ± 2	85 ± 2	
C4	% vol.	balance	balance	
<C3, >C4	% vol.	max. 2 %	max. 2 %	
Olefines	% vol.	9 ± 3	12 ± 3	
Evaporative residue	ppm	max. 50	max. 50	NFM 41-015
Water content		none	none	visual inspect.
Sulphur content	ppm mass */	max. 50	max. 50	EN 24260
Hydrogen sulphide		none	none	
Copper corrosion	rating	class 1	class 1	ISO 625 1 **/
Odour		Characteristic	Characteristic	
MON		min. 89	min. 89	EN 589 Annex B

*/ Value to be determined at standard conditions (293.2 K (20°C) and 101.3 kPa).

**/ This method may not accurately determine the presence of corrosive materials if the sample contains corrosion inhibitors or other chemicals which diminish the corrosivity of the sample to the copper strip. Therefore, the addition of such compounds for the sole purpose of biasing the test method is prohibited.

5. TECHNICAL DATA OF NG REFERENCE FUELS

		G20	G25
Composition:			
CH4	% vol	100	86
N2	% vol	0	14
Wobbe Index */	MJ/m^3	53.6 ± 2%	43.9 ± 2%

*/ Based on the gross calorific value and calculated for 0°C.

The constituing gases of the mixtures shall have at least the following purities:

N_2 : 99%
CH_4: 95%

with a total content of hydrogen, carbon monoxide and oxygen below 1 % and a total content of nitrogen and carbon dioxide below 2%

The Wobbe Index is the ratio of the calorific value of a gas per unit volume and the square root of its relative density under the same reference conditions:

$$Wobbe\ Index = H_{gas} \frac{\sqrt{\rho_{air}}}{\sqrt{\rho_{gas}}}$$

with H_{gas} = calorific value of the fuel in MJ/m^3 at 0°C

ρ_{air} = density of air at 0°C

ρ_{gas} = density of fuel at 0°C

The Wobbe Index is said to be gross or net according to whether the calorific value uses is the gross or net calorific value."

Insert a new annex 12, to read:

"Annex 12

GRANTING OF AN ECE TYPE APPROVAL FOR A VEHICLE FUELLED BY LPG OR NATURAL GAS

1. INTRODUCTION

This annex describes the special requirements that apply in the case of an approval of a vehicle that runs on LPG or Natural Gas, or that can run either on unleaded petrol or LPG or Natural Gas, insofar as the testing on LPG or Natural Gas is concerned.

In the case of LPG and Natural Gas there is on the market a large variation in fuel composition, requiring the fuelling system to adapt its fuelling rates to these compositions. To demonstrate this capability, the vehicle has to be tested in the test type I on two extreme reference fuels and demonstrate the self-adaptability of the fuelling system. Whenever the self-adaptability of a fuelling system has been demonstrated on a vehicle, such a vehicle may be considered as a parent vehicle of a family. Vehicles that comply with the

requirements to members of that family, if fitted with the same fuelling system, need to be tested on only one fuel.

2. DEFINITIONS

For the purposes of this annex:

2.1. A parent vehicle means a vehicle that is selected to act as the vehicle on which the self adaptability of a fuelling system is going to be demonstrated, and to which the members of a family refer. It is possible to have more than one parent vehicle in a family.

2.2. A member of the family is a vehicle that shares the following essential characteristics with its parent(s):

2.2.1. (a) It is produced by the same vehicle manufacturer.

(b) It is subject to the same emission limits.

(c) If the gas fuelling system has a central metering for the whole engine:

It has a certified power output between 0.7 and 1.15 times that of the engine of the parent vehicle;

If the gas fuelling system has an individual metering per cylinder:
It has a certified power output per cylinder between 0.7 and 1.15 times that of engine of the parent vehicle.

(d) If fitted with a catalyst system, it has the same type of catalyst i.e. 3-way, oxidation, deNOx.

(e) It has a gas fuelling system (including the pressure regulator) from the same system manufacturer and of the same type: induction, vapour injection (single point, multipoint), liquid injection (single point, multipoint).

(f) This gas fuelling system is controlled by an ECU of the same type and technical specification, containing the same software principles and control strategy.

2.2.2. With regard to requirement (c): in the case where a demonstration shows that two gas fuelled vehicles could be members of the same family with the exception of their certified power output, respectively P1 and P2 (P1<P2), and both are tested as if they were parent vehicles, the family relation will be considered valid for any vehicle with a certified power output between 0.7*P1 and 1.15*P2.

3. GRANTING OF AN ECE TYPE APPROVAL

ECE type approval is granted subject to the following requirements:

3.1. Exhaust emissions approval of a parent vehicle:

The parent vehicle should demonstrate its capability to adapt to any fuel composition that may occur across the market. In the case of LPG there are variations in C3/C4 composition. In the case of Natural Gas there are generally two types of fuel, high calorific fuel (H-gas) and low calorific fuel (L-gas), but with a significant spread within both ranges; they differ significantly in Wobbe Index. These variations are reflected in the reference fuels.

3.1.1. The parent vehicle(s) shall be tested in the test type I on the two extreme reference fuels.

3.1.1.1. If the transition from one fuel to another is in practice aided through the use of a switch, this switch shall not be used during type approval. In such a case on the manufacturer's request and with the agreement of the technical service the pre-conditioning cycle referred to in paragraph 5.3.1. of annex 4 may be extended.

3.1.2. The vehicle(s) is (are) considered to conform if, with both reference fuels, the vehicle complies with the emission limits.

3.1.3. The ratio of emission results 'r' should be determined for each pollutant as follows:

$$r = \frac{\{\textit{emission result on one reference fuel}\}}{\{\textit{emission result on the other reference fuel}\}}$$

3.2. Exhaust emissions approval of a member of the family:

For a member of the family a test of type I shall be performed with one reference fuel. This reference fuel may be either reference fuel. The vehicle is considered to comply if the following requirements are met:

3.2.1. The vehicle complies with the definition of a family member as defined under paragraph 2.2. above.

3.2.2. The test results for each pollutant will be multiplied with its factor 'r' (see paragraph 3.1.3. above), if r is greater than 1.0. If r is smaller than 1.0., its value will be taken as 1. The results of these multiplications shall be taken as the final emission result. On the manufacturer's request the test type I may be performed on

reference fuel 2 or on both reference fuels, so that no correction is needed.

3.2.3. The vehicle shall comply with the emission limits valid for the relevant category.

4. GENERAL CONDITIONS

4.1. Tests for conformity of production may be performed with a commercial fuel of which the C3/C4 ratio lies between those of the reference fuels in the case of LPG, or of which the Wobbe Index lies between those of the extreme reference fuels in the case of NG. In that case a fuel analysis needs to be present."